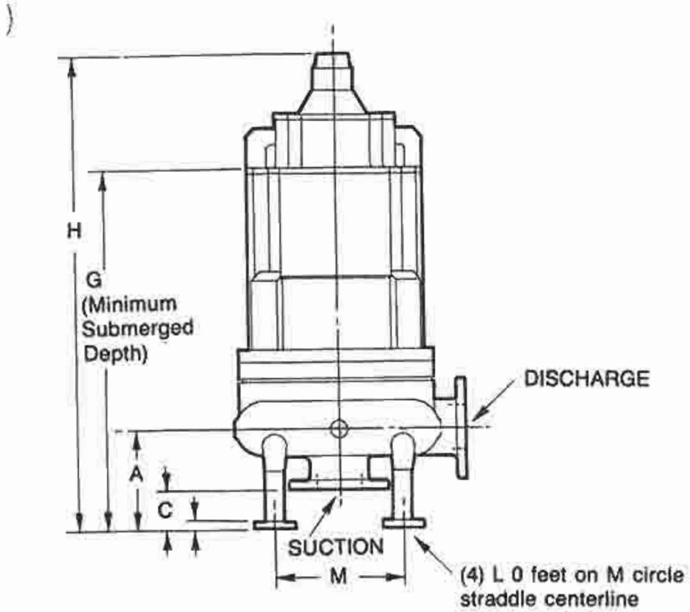
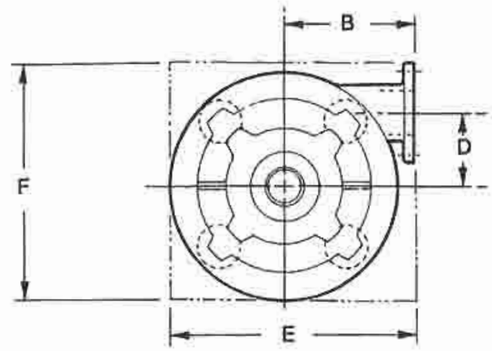
Dimensions Model HSUL

All dimensions in inches. Not to be used for construction.





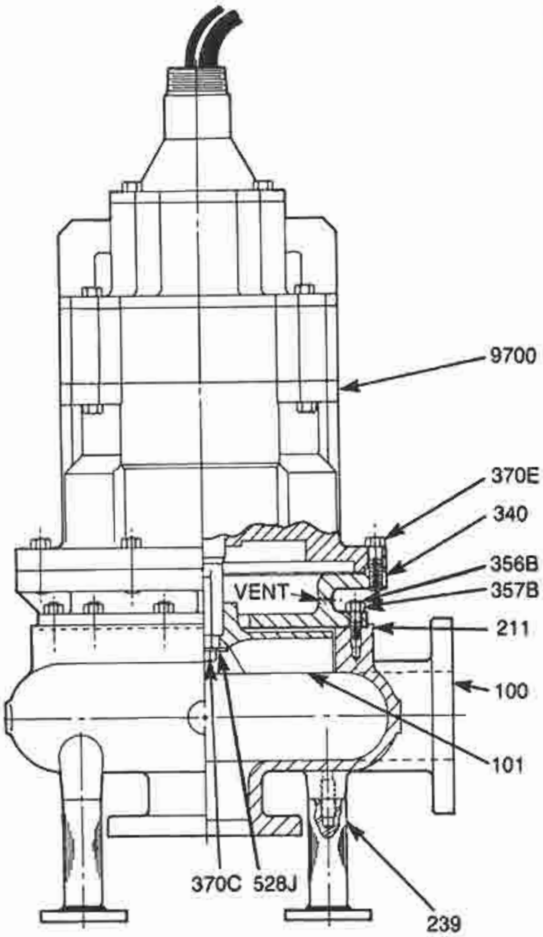
DIMENSIONS																		
PUMP SIZE	MOTOR FRAME	SUCTION AND DISCHAGE FLANGES (1)																WEIGHT LBS. APPROX.
		SIZE	O.D.	B.C.	THICK NESS	HOLE SIZE	HOLE QTY	A	B	C	D	E	F	G	H	L	M	
2x2-8	140TY	2	6.00	4.75	.62	.75	4	5.00	7.75	2.00	4.38	13.62	13.25	24.75	32.44	3.00	10.00	345
	180TY													26.75	33.88			385
	180TY/140													26.00	33.12			385
	210TY/180													31.38	39.62			500
3x3-10	140TY	3	7.50	6.00	.75	.75	4	7.50	9.62	3.00	5.50	17.31	16.94	28.38	36.12	3.50	13.25	415
	180TY											17.31	16.94	30.75	37.88			455
	210TY											17.31	16.94	34.50	42.69			570
	250TY											19.12	18.75	38.88	49.18			990
	320TY											17.31	16.94	41.50	53.75			1450
4x4-12	210TY	4	9.00	7.50	.94	.75	8	9.50	11.50	4.00	6.50	20.88	20.38	36.62	44.81	4.00	16.00	645
	250TY													41.38	51.75			1080
	320TY													44.00	56.25			1410
6x6-12	210TY	6	11.00	9.50	1.00	.88	8	13.50	13.00	6.00	6.50	23.38	22.38	42.12	50.38	4.00	16.00	765
	250TY													41.75	52.12			1200
	250TY/210													45.25	55.69			1200
	320TY													49.50	61.69			1675
6x6-18	360TY/320	6	11.00	9.50	1.00	.88	8	13.50	16.00	6.00	9.62	29.50	28.62	56.12	67.02	4.00	24.00	2025
6x6-12	320TY/250	6	11.00	9.50	1.00	.88	8	13.50	13.00	6.00	6.50	23.38	22.38	43.94	55.88	4.00	16.00	1600

NOTES: (1) SUCTION FLANGE IS NOT DRILLED.

Construction Details

	Frame Size	2x2-8	3x3-10	4x4-12	6x6-12	6x6-18
Net Weight - Lbs. (kg)	140	345 (156)	415 (188)	—	—	—
	180	385 (175)	455 (206)	—	—	—
	210	500 (227	570 (259)	645 (293)	765 (347)	—
	250	—	990 (449)	1080 (490)	1200 (544)	—
	320	—	1450 (658)	1410 (640)	1600 (726)	1675 (760)
	360	—	—	—	—	2025 (919)
Minimum Casing Thickness - in. (mm)		0.38 (97)	0.56 (142)	0.50 (127)	0.67 (170)	0.75 (191)
Maximum Solid Size - in. (mm)		2 (508)	3 (762)	4 (1016)	6 (1524)	6 (1524)
Working Pressure - PSIG (kPa)		100 (690)	100 (690)	100 (690)	100 (690)	70 (483)
Horsepower Limit - HP (kW)		15 (11)	50 (37)	100 (75)	150 (112)	125 (93)

Sectional View Model HSUL



Parts List and Materials of Construction

Part No.	Part Name	Material	
		Cast Iron	HC600
100	Casing	Cast Iron	HC600
101	Impeller	Cast Iron	HC600
211	Gasket	Rubb. Cloth	Rubb. Cloth
239	Support (Optional)	Steel	Steel
340	Motor Adapter	Cast Iron	HC600
356A	Stud (Optional)	302 SS	302 SS
356B	Stud	302 SS	302 SS
357B	Nut	302 SS	302 SS
370C	Cap Screw	302 SS	302 SS
370E	Cap Screw	302 SS	302 SS
528J	Washer	302 SS	302 SS
9700	Motor	—	—

Materials of Construction

Material	Specification
Cast Iron	ASTM A48-Classes 25 & 35
HC600	ASTM A532-75a, Class III, Type A-Annealed
302 SS	Stainless Steel — AISI 302

MOTOR DATA											
3 - Phase, 60 Hertz, 460 VAC Motors											
HP	RPM	Frame	Full Load Amperes	HP	RPM	Frame	Full Load Amperes	HP	RPM	Frame	Full Load Amperes
0.5	900	140TY	1.55	5	1800	180TY	7.40	25	1800	250TY	33.0
0.75	1200	140TY	1.60	5	1200	180TY	7.60	25	1200	250TY	34.0
0.75	900	140TY	2.27	5	900	210TY	8.80	25	900	320TY	36.0
1	1800	140TY	2.50	7.5	1800	180TY	10.50	30	1800	250TY	39.0
1	1200	140TY	2.10	7.5	1200	210TY	11.50	30	1200	320TY	40.0
1	900	180TY	2.20	7.5	900	250TY	12.70	40	1800	250TY	52.0
1.5	1800	140TY	3.00	10	1800	210TY	13.5	40	1200	320TY	53.3
1.5	1200	140TY	2.90	10	1200	210TY	15.5	50	1800	320TY	63.0
1.5	900	180TY	3.00	10	900	250TY	15.0	50	1200	320TY	67.0
2	1800	140TY	3.60	15	1800	210TY	21.0	60	1800	320TY	77.3
2	1200	140TY	3.70	15	1200	250TY	19.5	75	1800	320TY	92.0
2	900	180TY	3.80	15	900	250TY	25.0	100	1800	360TY	123
3	1800	140TY	5.20	20	1800	210TY	28.0	125	1800	360TY	153
3	1200	180TY	4.80	20	1200	250TY	27.0	135	1800	360TY	165
3	900	180TY	5.96	20	900	320TY	27.8	150	1800	360TY	NOT AVAIL.

PREDENITRIFICATION BASINS

Stearns & Wheeler
Companies

Client: IRG / USAID
Subject: WWTP Conceptual Design
Date:
Comp. By: AL
Job No.: 40295.21.1760
Checked By:
Sheet 1 of

PRE-DENITRIFICATION TANKS.

Influent Parameter		Full Flow
FBOD5	350.00 mg/L	5,050 lbs/day
TBOD5	725.00 mg/L	10,460 lbs/day
NH3-N	124.50 mg/L	1,796 lbs/day
Alkalinity	600.00 mg/L	8,657 lbs/day
TSS	725.00 mg/L	10,460 lbs/day
NO3-N	0.50 mg/L	7 lbs/day

Influent Raw + Recycle Values

	mg/L	lbs/day
FBOD	41.7	5,395
NH3-N	24.0	3,107
Alk	312.5	40,410
NO3-N	9.0	1,159

DENITRIFIC TANKS

Effluent of Anoxic Reactor

	mg/L	lbs/day
FBOD	18.9	2,439
NH3-N	24.0	3,107
Alk	340.9	44,086
NO3-N	1.000	129

OTHER TREATMENT UNITS (BOD & NITRIFICATION)

Effluent & Recycle Values

	mg/L	lbs/day
FBOD	3.0	43
NH3-N	15.0	216
Alk	276.4	3,988
NO3-N	10.0	145

Soluble BOD removed in Anoxic zone (DENIT TANK)

mg/L	lbs/day
22.9	2,955.53

(2.87 # BOD / # NO_3-N)

NO3-N removed in Anoxic Zone

mg/L	lbs/day
8.0	1,029.80

Alkalinity produced — 3.57 lb alk/lb NOx-N rem

mg/L	lbs/day
28.4	3,676.39

Effluent Alkalinity

mg/L	lbs/day
276.4	3,987.53

NH3-N assimulated from Influent BOD

mg/L	lbs/day
3.2	412.65

(4%)

NH3-N nitrified in aerobic zone

mg/L	lbs/day
9.0	1,167.24

Alkalinity removed in nitrification zone

mg/L	lbs/day
64.5	8,345.78

(7.15 # ALK / # NH_3)

REQUIRED VOLUME OF DENIT TANKS (48% FILL WITH MEDIA) = 63,385 ft³ (~ 1,800 m³)

SALR = 1.226 $\frac{g}{m^2 \cdot D}$

VLR = 0.29 $\frac{kg}{m^3 \cdot D}$

PDN 11 — PDN 21

$V_1 = V_2 = 900\ m^3$

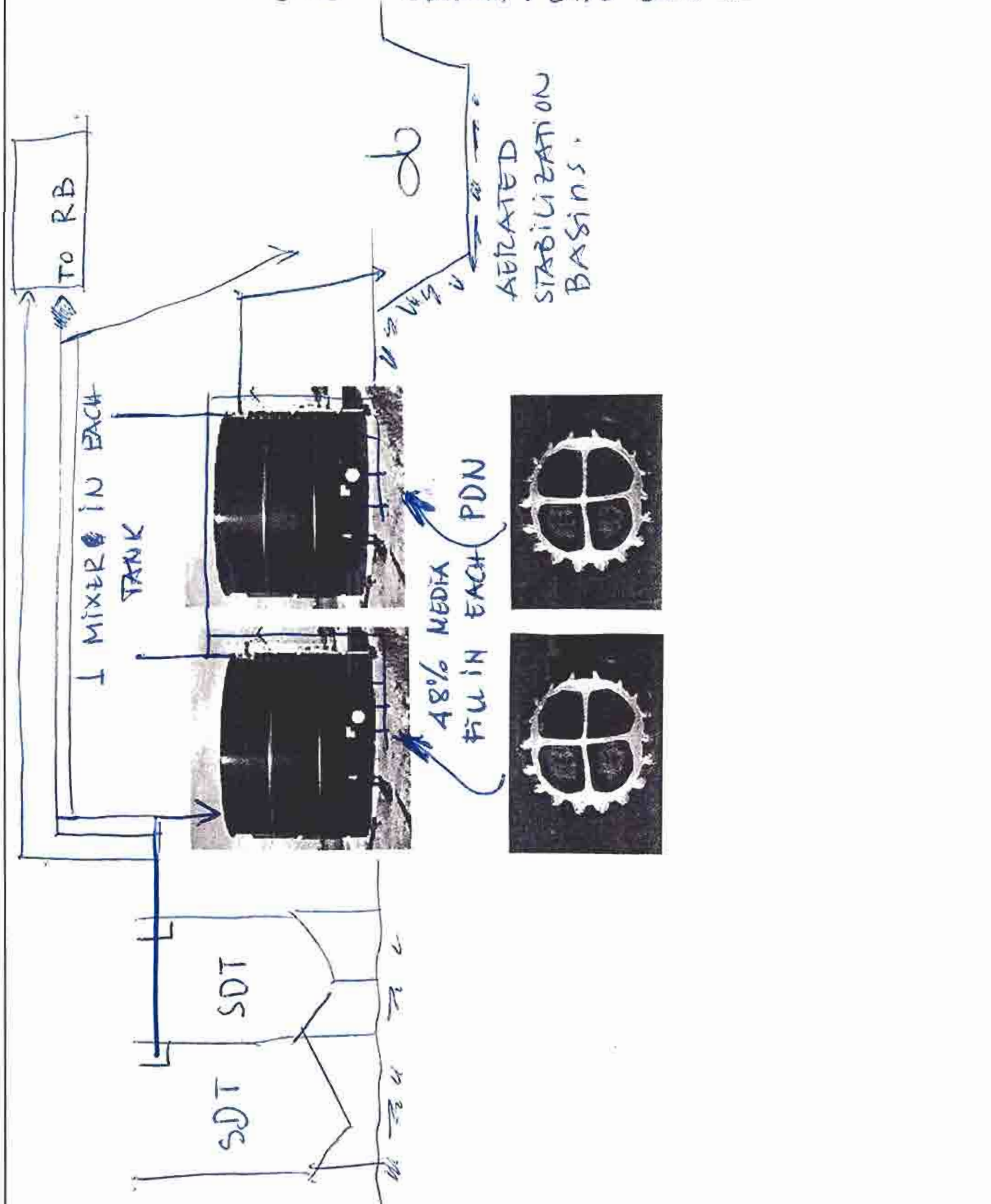
SALR = SURFACE LOADING
VLR = VOLUMETRIC LOADING

(*) THESE CALCS ASSUME ALL NO_x IS DENITRIFIED IN PDN

Stearns & Wheeler Companies

Client: IRG/USAID	Date:	Job No.: 40295.21.1700
Subject: MAFRAQ. CONCEPTUAL DESIGN	Comp. By: AK.	Checked By:

PDN CONCEPTUAL DESIGN



AERATED STABILIZATION BASINS

Client: Mafraq WWTP
Date:
Job No.: 40295.21.1700
Subject: ASB design.
Comp. By: AK
Checked By:

WITH MAX PERFORMANCE 2005

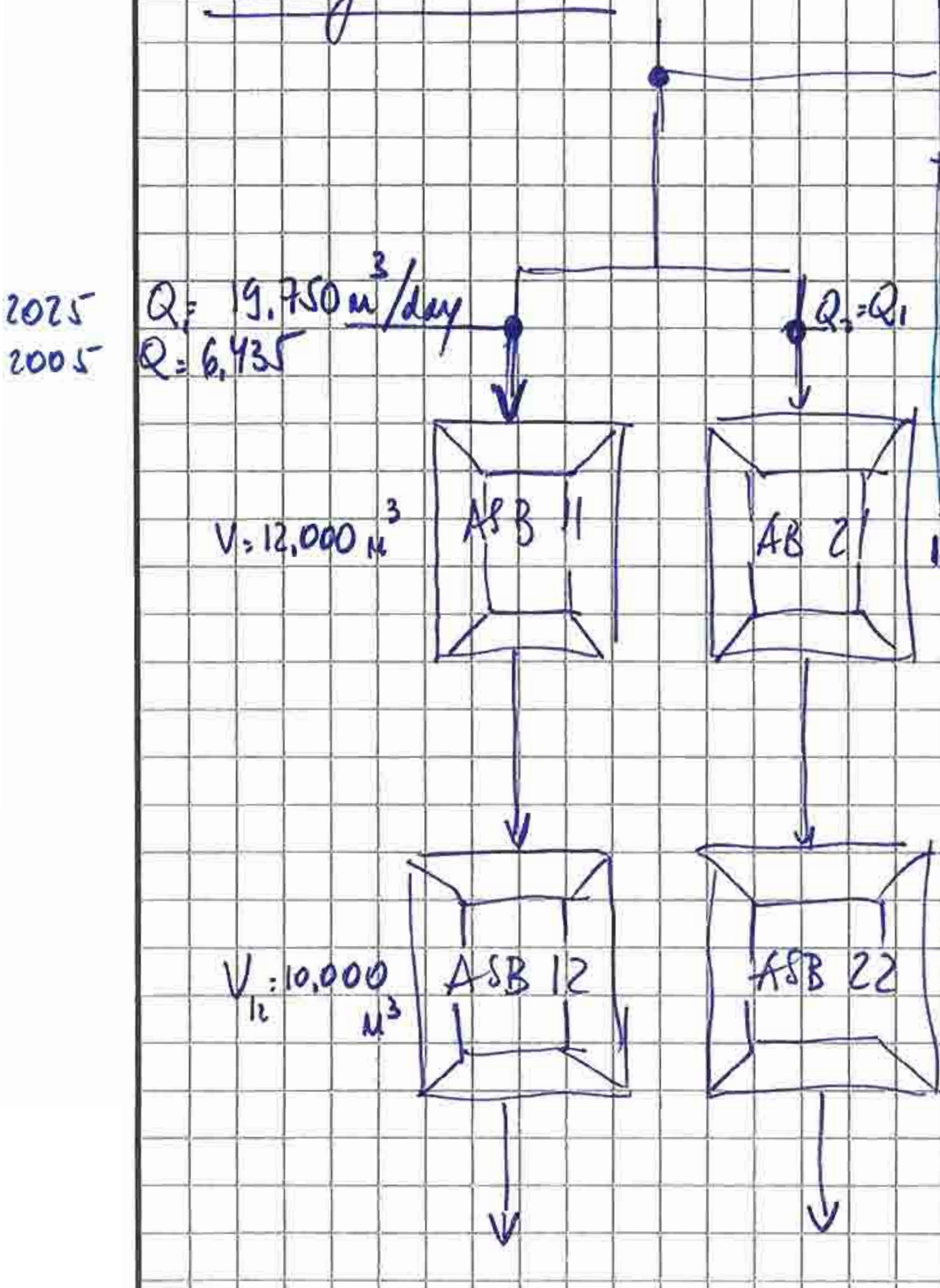
3/

Design data

$Q = Q + Q_R = $ 12,870 m/D.
BOD = 992 kg/D (8[illegible] mg/l)
Ammonia = 234 kg/d. (18 mg/l)
TKN = 285 kg/D. (22 mg/l)
TSS = 595 kg/d. (46 mg/l)

[2025]

Q = 39,500 m³/d.
BOD = 2,408 kg/d. (61 mg/l)
TSS = 1,445 kg/d. (36.6 mg/l)
TKN = 689 kg/d. (17.4 mg/l)
NH_3 = 554 kg/d. (14. mg/l)



Total V = 44,000 m³/day.

HRT (for average Q + 5 Recirculation) = ≈ 27 hours

Stearns & Wheler Companies

Client: Mapraq

Subject: ASB design.

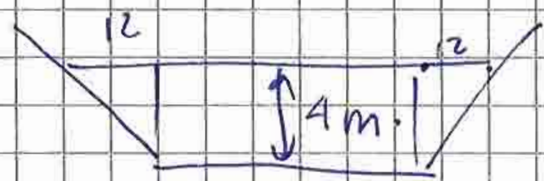
Date: | Job No.:

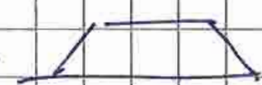
Comp. By: AK | Checked By:

ASB aeration

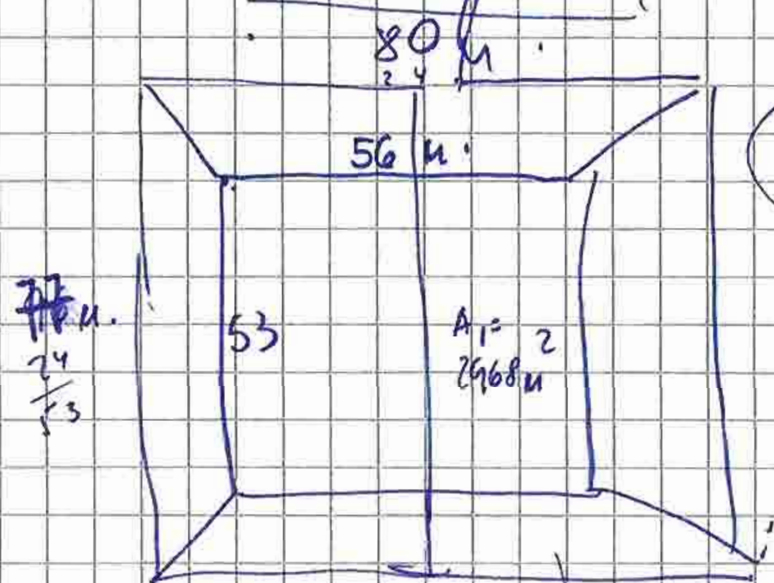
1) Due to size, the controlling factor is mixing → Rules for Complete mixing 25 - 30 HP/mgd.

ASB - 11 →



V = 

water depth.



$A_2 = 6160$

$V = 12,000\ m^3$
=
3,170,040 gall.

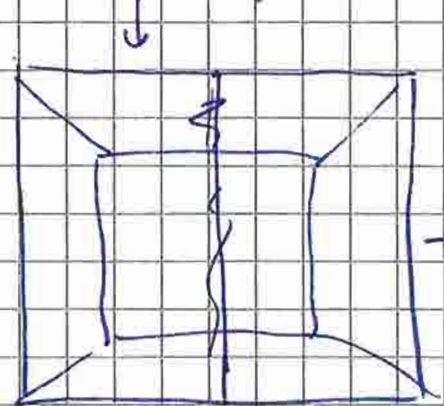
IRG/USAID
Client

Date | Job No.

Subject

AK
Comp. By | Checked By

(1) Completely mixed system



→ 2,000 diffusers

→ V = 423,720 ft^3

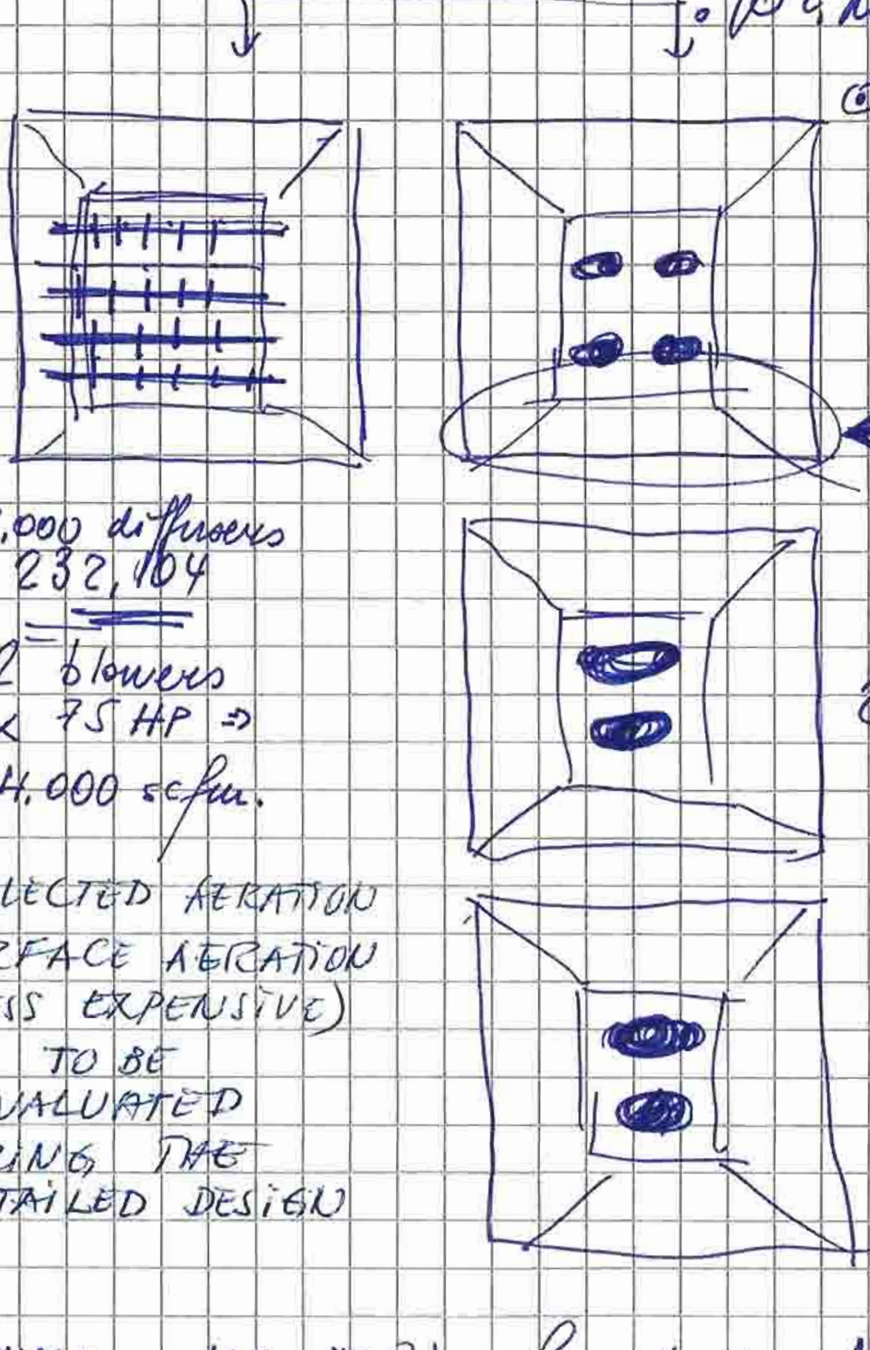
→ 10 to 15 scfm / 1,000 ft^3
(p. 49, MOP 13)

$$\frac{10 \text{ scfm}}{1000 \text{ ft}^3} \times 423{,}723 = \underline{\underline{4,230}} \text{ scfm}$$

per lagoon.

(•) We can use Midwestwater Management floating fine bubble diffusers
We have to accomodate all design conditions — 2005, 2015 & 2025

- capital more \$70,000
- O & M more 120 vs 150



4 x 30 HP
cost \$160,000
180 HP

Build this area as "Biolac"

final settling.

→ 2,000 diffusers
\$232,104

→ 2 blowers
x 75 HP ⇒

→ 4,000 scfm.

2 per basin

2 per basin

(*) SELECTED AERATION
SURFACE AERATION
(LESS EXPENSIVE)
TO BE
REEVALUATED
DURING THE
DETAILED DESIGN

US EPA factsheet Aerated, partial mix lagoons

partial mix req's : 1 to 2 watts/m^3 ($\frac{5 \text{ to } 10 \text{ HP}}{MG}$)

Complete mix : 25 to 30 HP/MG. ($\frac{0.3 \text{ to } 0.6 \text{ w}}{m^3}$)

Stearns & Wheler Companies

Client: IRG / USAID

Date:

Job No.: 40295.21.F700

Subject: MAFRAQ CONCEPTUAL DESIGN

Comp. By: AK

Checked By:

COSTS - (SURFACE AERATORS)

1. Twelve (12)- 30 HP Aqua-Jet floating aerators, model SS (all stainless steel), 50 HZ power............. ($17,025 each)........$204,300.00 total.
2. Twelve (12)- optonal adder for 5 year lubrication free Endura Series motor. (Note: The standard motor included in the price above requires lubrication twice per year. The optional adder for the "Endura Series" motor does not have to be lubricated for the first 5 years........($540 adder each)...$6,480.00 optional adder total.
3. Estimate for electrical cable, mooring cable, clips & thimbles (exact quanties not known until we see a layout of the basins)....($400/aerator)....$4,800.00 total.
4. Export boxing, containerization & documentation fees..estimate...$4,925.00
5. Freight from Rockford, IL to Aquabah, Jordan (1-40' container and 6- 96"x96"x40" boxes)...estimate...$26,003.00

United States
Environmental Protection
Agency

Wastewater Technology Fact Sheet
Aerated, Partial Mix Lagoons

DESCRIPTION

Partial mix lagoons are commonly used to treat municipal and industrial wastewaters. This technology has been widely used in the United States for at least 40 years. Aeration is provided by either mechanical surface aerators or submerged diffused aeration systems. The submerged systems can include perforated tubing or piping, with a variety of diffusers attached.

In aerated lagoons, oxygen is supplied mainly through mechanical or diffused aeration rather than by algal photosynthesis. Aerated lagoons typically are classified by the amount of mixing provided. A partial mix system provides only enough aeration to satisfy the oxygen requirements of the system and does not provide energy to keep all total suspended solids (TSS) in suspension.

In some cases, the initial cell in a system might be a complete mix unit followed by partial mix and settling cells. Most energy in complete mix systems is used in the mixing function which requires about 10 times the amount of energy needed for an equally-sized partial mix system to treat municipal wastes. A complete mix wastewater treatment system is similar to the activated sludge treatment process except that it does not include recycling of cellular material, resulting in lower mixed liquor suspended solids concentrations, which requires a longer hydraulic detention time than activated sludge treatment.

Some solids in partial mix lagoons are kept in suspension to contribute to overall treatment. This allows for anaerobic fermentation of the settled sludges. Partial mix lagoons are also called facultative aerated lagoons and are generally designed with at least three cells in series, with total detention time dependent on water temperature. The lagoons are constructed to have a water depth of up to 6 m (20 ft) to ensure maximum oxygen transfer efficiency when using diffused aeration. In most cases, aeration is not applied uniformly over the entire system. Typically, the most intense aeration (up to 50 percent of the total required) is used in the first cell. The final cell may have little or no aeration to allow settling to occur. In some cases, a small separate settling pond is provided after the final cell. Diffused aeration equipment typically provides about 3.7 to 4 kg O_2/kW-hour (6 to 6.5 lbs O_2/hp-hour) and mechanical surface aerators are rated at 1.5 to 2.1 kg O_2/kW-hour (2.5 to 3.5 lbs O_2/hp-hour). Consequently, diffused systems are somewhat more efficient, but also require a significantly greater installation and maintenance effort.

Aerated lagoons can reliably produce an effluent with both biological oxygen demand (BOD) and TSS ≤ 30 mg/L if provisions for settling are included at the end of the system. Significant nitrification will occur during the summer months if adequate dissolved oxygen is applied. Many systems designed only for BOD removal fail to meet discharge standards during the summer because of a shortage of dissolved oxygen. Nitrification of ammonia and BOD removal occur simultaneously and systems can become oxygen limited. To achieve nitrification in heavily loaded systems, pond volume and aeration capacity beyond that provided for BOD removal are necessary. Oxygen requirements for nitrification are more demanding than for BOD removal. It is generally assumed that 1.5 kg of oxygen is required to treat 1 kg of BOD. About 5 kg of O_2 are theoretically required to convert 1 kg of ammonia to nitrate.

APPLICABILITY

An aerated lagoon is well suited for municipal and industrial wastewaters of low to medium strength. While such systems are somewhat land intensive,they require much less area than a facultative lagoon and can provide a better level of treatment. Operation and management requirements are also less than those required for activated sludge and similar technologies.

A physical modification to an aerated lagoon uses plastic curtains supported by floats and anchored to the bottom to divide existing lagoons into multiple cells and/or serve as baffles to improve hydraulic conditions. A recently developed approach suspends a row of submerged diffusers from flexible floating booms which move in a cyclic pattern during aeration activity. This serves to treat a larger volume with each aeration line. Effluent is periodically recycled within the system to improve performance. If there is sufficient depth for effective oxygen transfer, aeration is used to upgrade existing facultative ponds and is sometimes used on a seasonal basis during periods of peak wastewater discharge to the lagoon (e.g. seasonal food processing wastes).

ADVANTAGES AND DISADVANTAGES

Advantages and disadvantages of aerated, partial mix lagoons are listed below:

Advantages

Require less land than facultative lagoons.

Require much less land than facultative ponds, depending on the design conditions.

An aerated lagoon can usually discharge throughout the winter while discharge may be prohibited from an ice-covered facultative lagoon in the same climate.

Sludge disposal may be necessary but the quantity will be relatively small compared to other secondary treatment processes.

Disadvantages

Aerated lagoons are not as effective as facultative ponds in removing ammonia nitrogen or phosphorous, unless designed for nitrification.

Diurnal changes in pH and alkalinity that affect removal rates for ammonia nitrogen and phosphorous in facultative ponds do not occur in aerated ponds.

Aerated lagoons may experience surface ice formation.

Reduced rates of biological activity occur during cold weather.

Mosquito and similar insect vectors can be a problem if vegetation on the dikes and berms is not properly maintained.

Sludge accumulation rates will be higher in cold climates because low temperature inhibits anaerobic reactions.

Requires energy input.

DESIGN CRITERIA

Equipment typically required for aerated lagoons includes the following: lining systems, inlet and outlet structures, hydraulic controls, floating dividers and baffles, aeration equipment.

Every system should have at least three cells in series with each cell lined to prevent adverse groundwater impacts. Many states have design criteria which specify design loading, the hydraulic residence time, and the aeration requirements. Pond depths range from 1.8 to 6 m (6 to 20 ft), with 3 m (10 ft) the most typical (the shallow depth systems usually are converted facultative lagoons). Detention times range from 10 to 30 days, with 20 days the most typical (shorter detention times use higher intensity aeration). The design of aerated lagoons for BOD removal is based on first-order kinetics and the complete mix hydraulics model. Even though the system is not completely mixed, a conservative design will result. The model commonly used is:

$$C_e = C_o/[1 + (K_T)(t)/n]^n$$

where:

C_e = effluent BOD

C_o = influent BOD

K_T = temperature dependent rate constant

K_{20} = rate constant at 20 C

$K_{20} = 0.276\ d^{-1}$ at 20 C

= temperature coefficient (1.036)

$K_T = K_{20}\ ^{(T-20)}$

T = temperature of water

t = total detention time in system

n = number of equal sized cells in system

Detention times in the settling basin or portion of a basin used for settling of solids should be limited to two days to limit algae growth. The design of inlet and outlet structures should receive careful attention.

PERFORMANCE

BOD removal can range up to 95 percent. Effluent TSS can range from 20 to 60 mg/L, depending on the design of the settling basin and the concentration of algae in the effluent. Removal of ammonia nitrogen in aerated lagoons is usually less effective than in facultative lagoons because of shorter detention times. Nitrification of ammonia can occur in aerated lagoons or if the system is specifically designed for that purpose. Phosphorus removal is also less effective than in facultative lagoons because of more stable pH and alkalinity conditions. Phosphorus removals of about 15 to 25 percent can be expected with aerated lagoons. Removal of coliforms and fecal coliforms can be effective, depending on detention time and temperature. Disinfection may be necessary if effluent limits are less than < 200 MPN/100 mL.

The aerated lagoon system is simple to operate and reliable in performance for BOD removal. TSS removal can be influenced by the presence of algae in the lagoon, but generally is acceptable. The service life of a lagoon is estimated at 30 years or more.

OPERATION AND MAINTENANCE

Limitations

Depending upon the rate of aeration and the environment, aerated lagoons may experience ice formation on the water surface during cold weather periods. Reduced rates of biological activity also occur during cold weather. If properly designed, a system will continue to function and produce acceptable effluents under these conditions. The potential for ice formation on floating aerators may encourage the use of submerged diffused aeration in very cold climates. The use of submerged perforated tubing for diffused aeration requires maintenance and cleaning on a routine basis to maintain design aeration rates. There are numerous types of submerged aeration equipment that can be used in warm or cold climates, which should be considered in all designs. In submerged diffused aeration, the routine application of HCl gas in the system is used to dissolve accumulated material on the diffuser units.

Any earthen structures used as impoundments must be periodically inspected. If left unchecked, rodent damage can cause severe weakening of lagoon embankments.

Energy

Typically, operation occurs by gravity flow in and out of the lagoon. Energy would be required if pumps are necessary for either influent or effluent. Energy is required for the aeration devices, with the amount depending on the intensity of mixing desired. Partial mix systems require between 1 and 2 watts per cubic meter (5 and 10 horsepower per million gallons) of capacity, depending on the depth and configuration of the system.

$$E = 6598\ (HP)^{1.026}$$

where:

E = electrical energy, kWh/yr

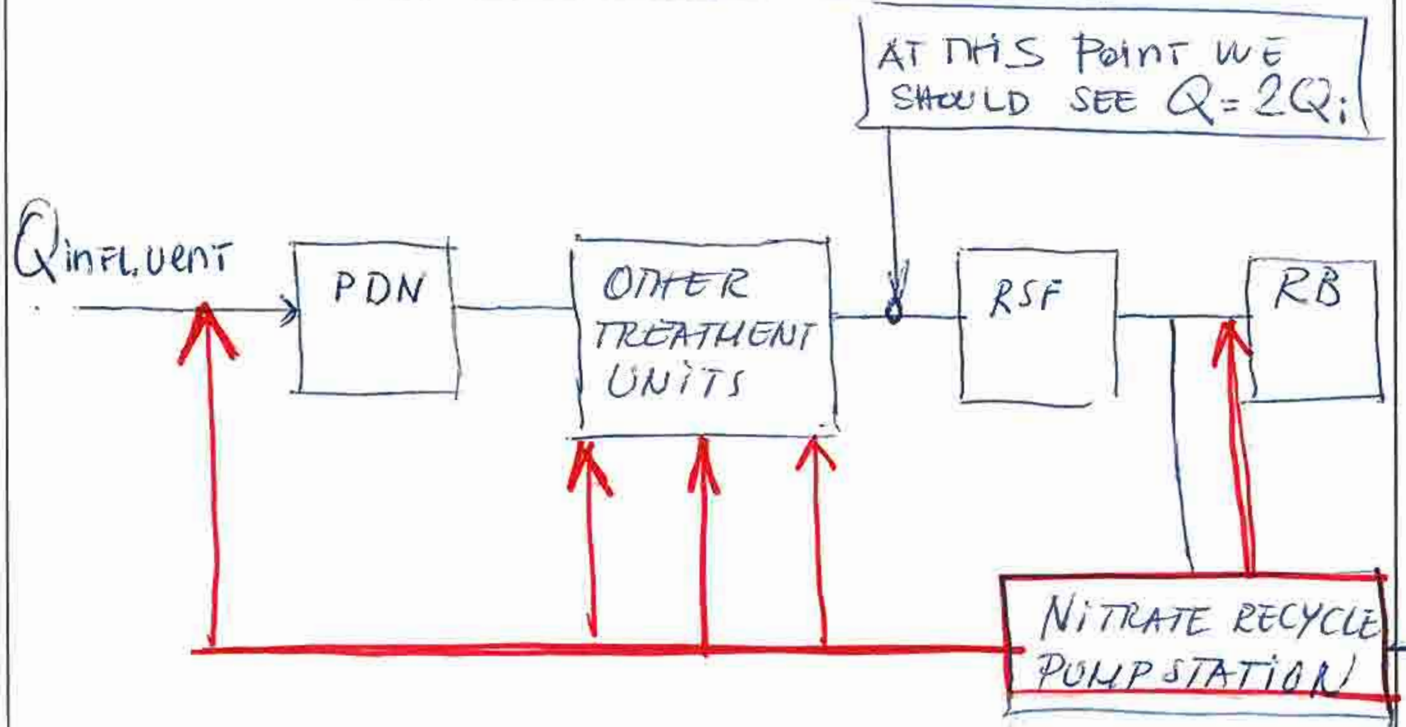
HP = aerator horsepower, hp

RECIRCULATING SAND FILTERS

Stearns & Wheler Companies

Client: IRG / USAID
Date:
Job No.: 40295.21.1700.
Subject: MAFRAQ CONCEPTUAL DESIGN
Comp. By: AK
Checked By:

Selected RSF Method of Operation / Design



NRPS Recycle Flows Range

	Units	1:1	2:1	3:1	4:1	5:1
2005	m^3/day	2,145	4,290	6,435	8,580	10,725
2015	m^3/day	4,476	8,952	13,428	17,904	22,380
2025	m^3/day	6,550	13,100	19,650	26,600	32,750

RSF - REQUIRED SURFACE AREA (AT SELECTED HYDRAULIC LOADING OF $0.26\ m^3/m^2/day$

$A = 50{,}000\ m^2$ or 10 RSF × $5{,}000\ m^2$ EACH

(*) SEE CONSTRUCTION DETAILS ON FIGURE 9

Stearns & Wheler Companies

Client: JRG / US AID	Date: 200295.21.1700	Job No.
Subject: MAFRAQ CONCEPTUAL DESIGN	Comp. By: AK	Checked By

NOTES ① WE SELECTED TO SIZE THE RSF FOR 2Q, TO MINIMIZE THE SIZE AND THE COSTS.

2. THE PROJECT IN DRARGA, MOROCCO SPLITS IN SIMILAR FASHION THE NITRATE RICH FLOW BETWEEN THE RSFs AND THE REED BEDS. THE REED BEDS DENITRIFY MORE EFFIC THAN THE RSF's, AND PRODUCE A VALUABLE BY PRODUCT ∴ SO USE THEM AT LEAST EQUALLY TO THE RSFS.

REED BEDS

REED BEDS

1) BASED ON THE POSSIBLE BY-PASS OF SOME NITRATES TO THE RB, DESIGN (+) NO_x LOAD OF ~ 80 KG NO_x / HA (10,000 m²)

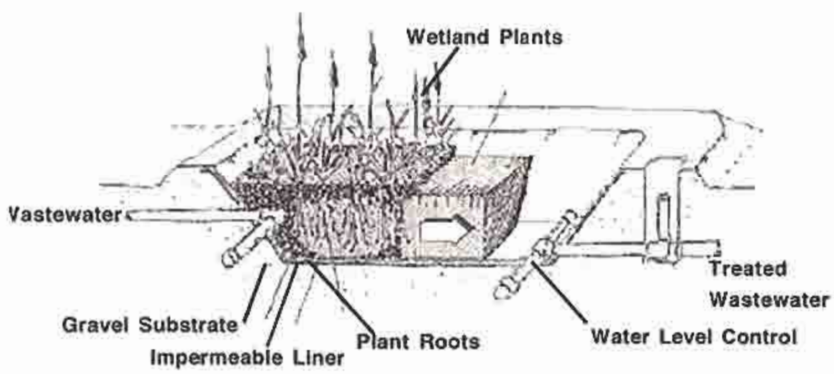
. LET'S ASSUME THAT FROM TOTAL NITRATE MASS OF 535 KG/DAY

CONSERVATIVE FIGURES, BUT REQUIRED FOR 10 mg NO_x/L.

~ 300 KG/D. DENITRIFIED IN THE PDN TANKS.

~ 240 KG / HA / D. DENITRIFIED IN THE REED BEDS.

RB → REQUIRED TOTA SURFACE AREA OF THE REED BEDS ~ 30,000 m²
OR
10 BEDS × 3,000 m².



Wetland plants and associated microorganisms treat wastewater as it flows through a constructed wetland system.

How are they built?

Constructed wetlands are generally built on uplands and outside floodplains or floodways in order to avoid damage to natural wetlands and other aquatic resources. Wetlands are frequently constructed by excavating, backfilling, grading, diking and installing water control structures to establish desired hydraulic flow patterns. If the site has highly permeable soils, an impervious, compacted clay liner is usually installed and the original soil placed over the liner. Wetland vegetation is then planted or allowed to establish naturally.

(*) FOR SUGGESTED DESIGN DETAILS CONSULT THE TYPICAL DETAILS, FIGURE 10.

RECIRCULATING PUMP STATION

(1) DESIGN CRITERIA

- We must recycle from 100% to 500%
- Recycle flowrates based on

$Q_{average} = 6,550 \ m^3/day$ (100%)

$Q_{max} = 32,750 \ m^3/day$

But we must also have the ability to run from start up, when $Q = 2,227 \ m^3/day$ (2005) to

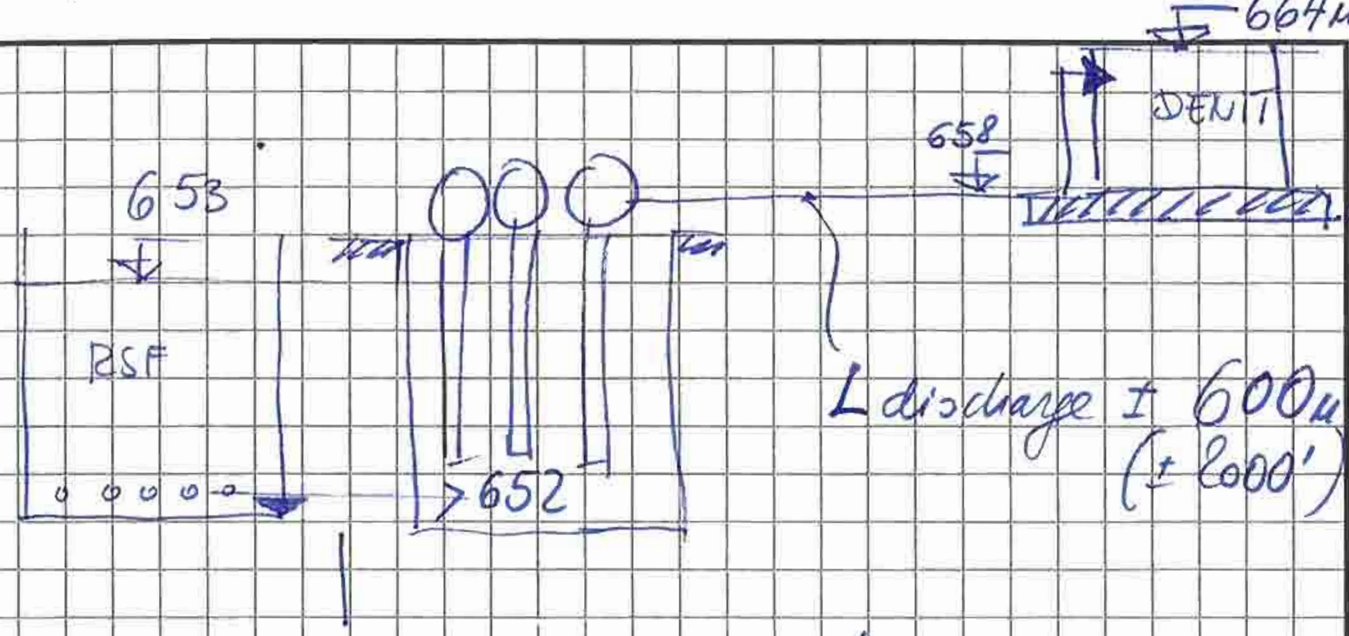
→ $Q = 4,476 \ m^3/d$ - 2015)

	100%	200%	300%	400%	500%
2005	2,145	4,290	6,435	8,580	10,725
2015	4,476	8,952	13,428	17,904	22,380
2025	6,650	13,300	19,650	26,600	32,750

If we select 3 pumps → $Q = \underline{10,916}$
4th pumps → Standby

$Q = 10,916 \ m^3/day = (\pm 2,000 \ gpm)$

- We can cover the green range with 3 pumps



TDH = 12m + Δh.

Discharge pipe selection →

$Q_1 + Q_2 + Q_3 = 6{,}000$ gpm.

If Φ 1200 mm →

at Q = 2,000 gpm → 0.35 ft/s.
at 6000 gpm → V = 10.63
} too big.

Change Φ to 1500 mm (60")

V at 4,000 gpm = 4.55 ft/sec.
V at 6,000 gpm = 6.81 ft/sec.

$\Delta h = \frac{0.72}{100'} \times 2{,}000' \approx 15'$

$TDH = 40' + 15' + \underset{(misc)}{10'} = \underline{\underline{65'}}$

Stearns & Wheler Companies

IRG / USAIDS
Client

Date

40295.21.1700
Job No.

MAFRAQ CONCEPTUAL DESIGN
Subject

AK
Comp. By

Checked By

Possible Selection

Fairbank Morse → 40 BHP

~ 40 kW.

Model 13H - 7000

1770 RPM.

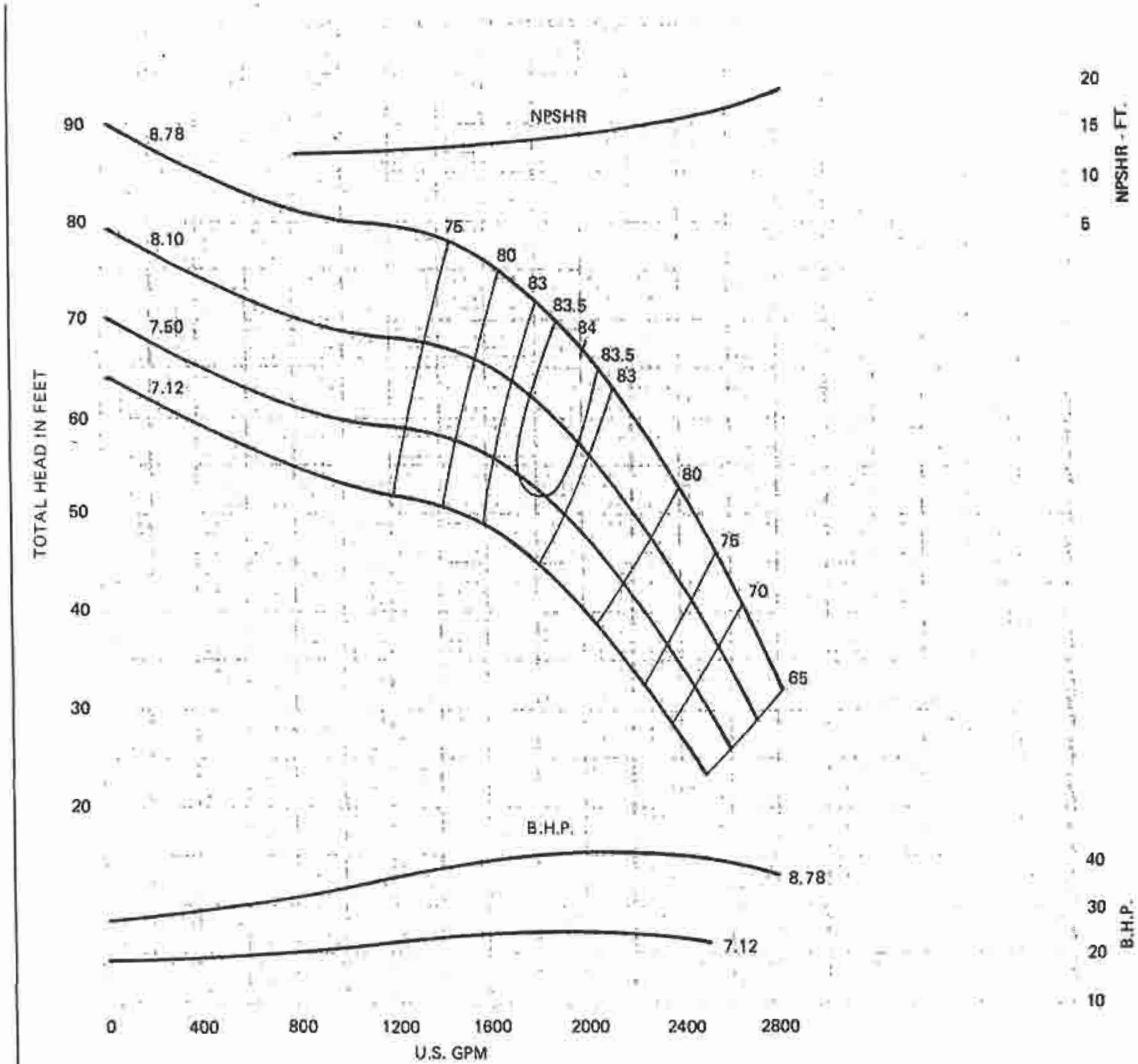
solids size = 254 mm.

∴ 3 pumps × 40 kW ⇒ 120 kW.

13H 7000

1770 RPM

ENCLOSED IMPELLER T7EKA99



EFFICIENCY CORRECTIONS[1]

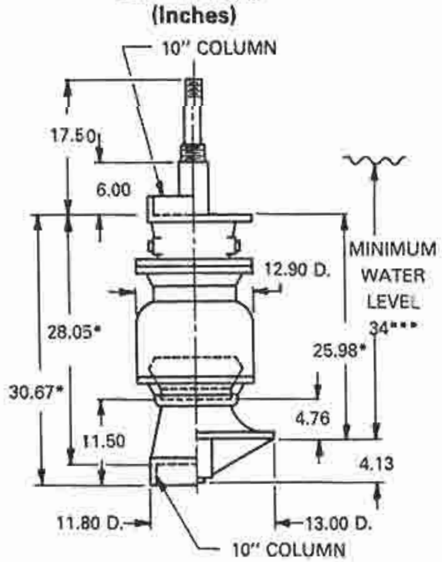
NUMBER OF STAGES	EFFICIENCY CHANGE
1	-2.0 POINTS
2	-1.5 POINTS
3	-0.5 POINTS
4	NO CHANGE
5	NO CHANGE
6 OR MORE	NO CHANGE

BOWL MATERIAL	EFFICIENCY CHANGE
CAST IRON	-2.0 POINTS
ENAMELED C.I.	NO CHANGE

IMPELLER MATERIAL	EFFICIENCY CHANGE
CAST IRON	-1.0 POINTS
BRONZE	NO CHANGE
ENAMELED C.I.	+1.0 POINT

(1) Refer to "Application and Reference Data" for head correction.

DIMENSIONS (Inches)



*Add 13.06 for each additional stage

TECHNICAL DATA

DATA	VALUE
MAXIMUM OPERATING SPEED	2300 RPM
MAXIMUM NUMBER OF STAGES	11**
PUMP SHAFT DIAMETER	$1\frac{11}{16}$ IN.
IMPELLER EYE AREA	28.40 SQ. IN.
MAXIMUM SPHERE SIZE	1.00 IN.
K_t (THRUST FACTOR)	12.02 LBS./FT.
K_a (ROTOR WT. PER STAGE)	43.30 LBS.
BOWL WT. (FIRST STAGE)	327 LBS.
BOWL WT. (EACH ADD'L. STAGE)	157 LBS.
ALLOWABLE SHAFT STRETCH	.80 IN.**
WK^2 (FIRST STAGE)	3.11 LBS.-FT.^{2}
WK^2 (EACH ADD'L. STAGE)	3.05 LBS.-FT.^{2}
BOWL RING CLEARANCE	.014/.018 IN.

** These are nominal values. Refer to "Application and Reference Data" for information further limiting or extending these values.

*** This value is the minimum submergence required to prevent vortexing only. This value may need to be increased to provide adequate NPSHA.

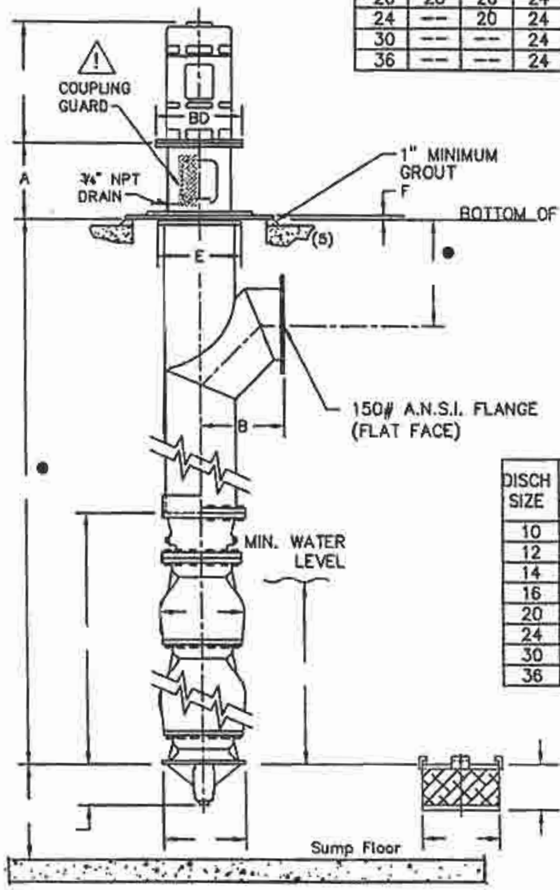
(4)

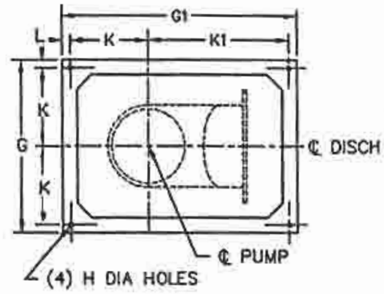
⚠ WARNING

DO NOT OPERATE THIS MACHINE WITHOUT PROTECTIVE GUARD IN PLACE. ANY OPERATION OF THIS MACHINE WITHOUT PROTECTIVE GUARD CAN RESULT IN SEVERE BODILY INJURY.

DISCH SIZE	A MTR BASE DIA					B	E	F	G	G1	H	K	K1	L
	12	16½	20	24½	30½									
10	20	--	--	--	--	13	13¾	1	23	35	⅞	9½	21½	2
12	20	20	--	--	--	15	16¼	1	26	40	⅞	11	25	2
14	20	20	24	--	--	17	17½	1	29	43	⅞	12½	26½	2
16	20	20	24	--	--	20	19½	1	32	48	1	14	30	2
20	20	20	24	24	30	24	23¾	1	44	60	1	20	36	2
24	--	20	24	24	30	29	28	1	50	68	1	23	41	2
30	--	--	24	24	30	36	34	1	54	80	1⅛	25	51	2
36	--	--	24	24	30	43	40	1	66	94	1⅛	31	59	2

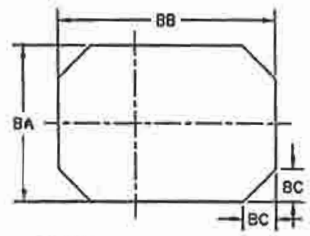
DRIVER IS SHIPPED SEPARATELY





PLAN VIEW OF SOLE PLATE (2)

DISCH SIZE	FLOOR OPENING DIMENSIONS		
	BA	BB	BC
10	18	30	5
12	21	35	6
14	24	38	7
16	27	43	8
20	38	54	11
24	43	61	12
30	45	71	13
36	57	85	16



PLAN VIEW OF FLOOR OPENING

1. THIS DRAWING NOT FOR CONSTRUCTION OR INSTALLATION UNLESS CERTIFIED. DIMENSIONS SHOWN ARE TYPICAL AND MAY VARY DUE TO VARIOUS TOLERANCES.
2. SOLEPLATE MUST BE SUPPORTED ON ALL 4 SIDES AND GROUTED IN PLACE.
3. MAXIMUM SUBMERGENCE REQUIRED AT MAXIMUM FLOW
4. MINIMUM DIAMETER REQUIRED TO REMOVE BOWL ASSEMBLY
5. DETAIL SHOWN FOR ILLUSTRATION ONLY AND IS NOT INTENDED TO REPRESENT THE ACTUAL INSTALLATION.

● CUSTOMER TO VERIFY/ADVISE OVERALL LENGTH AND LOCATION OF DISCHARGE AT RELEASE.

CUSTOMER		P.O.		Fairbanks Morse PENTAIR PUMP GROUP
JOB NAME		SERVICE		
PUMP SIZE & MODEL	STAGES	GPM	TDH	RPM	ROT CCW
MOTOR	HP	FRAME	PHASE	HERTZ	VOLTS	ENCL
CERTIFIED FOR	CERTIFIED BY	DATE	

SETTING PLAN
MODEL 7000
"UF" U.G. PEDESTAL
WITH SOLEPLATE

DWG. NO. 7000FS014 REV

5

SLUDGE STABILIZATION/STORAGE BASINS

Stearns & Wheler Companies

Client: Mafraq WWTP — Aerobic digestion
Date:
Job No.: 40295.21.1700
Subject: CONCEPTUAL DESIGN
Comp. By: AK
Checked By:

Sludge stabilization mixing / design.

1) diffused air - $>0.06\ m^3/m^3\cdot min$
(scfm / 1,000 ft^3) > 60

2) Mechanical system →

0.0263 – 0.0329 kw/m^3

or

1 TO 1.25 HP/1,000 ft^3 (134 HP/MGD.

3) VSS loading = 0.384 TO 1.6 kg VSS/m^3-d.

Aeration/mixing → enough to keep the solids in suspension and to maintain a DO of 1-2 mg/l

(*) Could vary from: 3 TO 30 mg/hr/gram of VSS under aeration

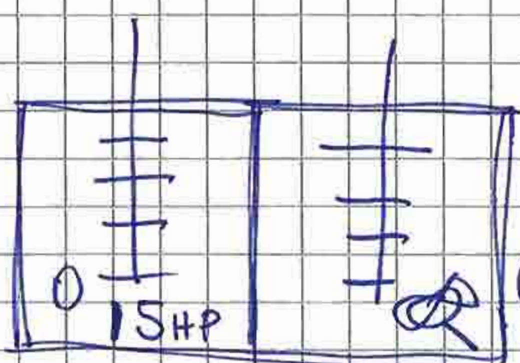
4) VSS reduction 35-50%

5) Volume allowance – N/a

6) SRT = 10-15 days

V digester $= \dfrac{830\ m^2 : 2}{415\ m^3 \text{ each.}}$

$\dfrac{0.0300\ kW}{m^3} \times 413\ m^3 = \underline{\underline{12\ kW}}$ per cell



15 HP surface aerators or jet aeration.